Improved spectral resolution in time-varying interferometry

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A b s t r a c t:

In this work, we present a procedure that allows increasing the resolution of dynamic length measurements made by spectral interferometry. The proposed scheme leads to obtaining a compact photonic instrument with the ability to measure distances, variations on positions and vibrations with a very high resolution. This measurement system includes a superluminescent source (SLED), a digital spectrometer and a Fizeau interferometer. Spectral data is processed by applying Fourier domain techniques previously applied in optical coherence tomography. The resolution of the spectral measurement system is determined by the spectrometer bandwidth and the light source employed. A signal is obtained by analysing the time evolution of a single pixel from the spectrometer CCD sensor, which is later analysed using time domain interferometry (TDI) techniques. This procedure works by detecting changes in the optical path below those that can be detected by spectral analysis. The original resolution obtained with the solely spectral techniques was 2.2 μm but was improved to 40 nm by complementary analysis of temporal signals.